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THERMAL PROPERTIES OF CHANNELS IN THE AEOLIS QUADRANGLE:
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High spatial resolution thermal data (with individual spot sizes down to 2 by 5 km) for the Elysium and Aeolis quadrangles of Mars have been compiled for comparison with surface features visible in orbiter images (1,2). Data for the Aeolis quadrangle (0° to 30° S, 180° W to 225° W) were used to determine the physical properties of channel materials in an attempt to constrain the processes active during the formation of the channels. The results, however, point to the dominance of aeolian materials in characterizing the thermal properties of the surface materials within the channels. The channels apparently act as topographic traps for transportable aeolian materials, similar to the trapping of dark aeolian materials within craters (3). This conclusion indicates that remote sensing results sensitive to properties of the uppermost several centimeters of the surface may not be directly related to the processes that produced the channel morphology in the Aeolis region.

Two prominent channels are located within the Aeolis quadrangle. Ma'adim Vallis cuts a slightly sinuous path over 900 km long through cratered plains typical of the southern hemisphere of the planet, more or less following the 183° W meridian from 28° S to 16° S latitudes (Fig. 1). Al-qahira Vallis follows a rectilinear path, presumably reflecting tectonic control of zones of weakness within the crust, for over 600 km from approximately 22° S, 200° W to 14° S, 195° W (Fig. 2). Both channels vary in width from approximately 10 km near their headward ends to 15 - 25 km near their distal ends. Both channels flow down a $1/2^{\circ}$ slope that encompasses the 3 km drop in elevation from the heavily cratered southern highlands to the sparsely cratered northern plains. These channels are large enough to be resolved from their surroundings by the thermal data and they represent the only channel material mapped by Scott and Carr (4) in the Aeolis quadrangle. A digitized version of the Scott and Carr map is included in the Mars Consortium data sets (5). The digitized locations of channel material were used to determine the thermal properties of this unit (2,6).

The distribution of thermal inertias for the channel material (Fig. 2, top) is distinct from the bimodal distribution obtained for $1.7 \times 10^6 \text{ km}^2$ of the Elysium and Aeolis quadrangles (Fig. 3, bottom). The channel material has thermal inertias ranging from 3.5 to $12.5 (\times 10^{-3} \text{ cal cm}^{-2} \text{ s}^{-1/2} \text{ K}^{-1})$ with a modest mode near a value of 8. This distribution is quite distinct from the low thermal inertias obtained for units in the northern plains while it is similar to the thermal inertias obtained from all of the units in the southern highlands (2). There is no indication of an increase in thermal inertia with distance down the channels, unlike the results from the Kasai Vallis area (7). The channel thermal inertias are in good agreement with thermal inertias obtained for dark intracrater deposits all over the planet (3), except that the channel material does not include the very high thermal inertias (up to 26) observed for some intracrater deposits. The modal value of 8 corresponds to an effective grain size of 0.5 mm representative of medium sand, assuming the surface materials are homogeneous and unconsolidated (8). Low resolution orbiter images (684A01,3,5,7) show the presence of dark materials collected within the channels along much of the channel lengths. The contrast of this material at different visual wavelengths is consistent with the spectral properties

of dark patches and splotches found elsewhere on Mars (9). These results all support the interpretation that dark aeolian material has accumulated between the topographic confines of the channel walls. This aeolian material need only be 10s of cm thick to completely mask the underlying materials from remote observation at thermal wavelengths. Other portions of the planet might be less dominated by aeolian materials, possibly allowing the properties of channel wall and floor materials to be directly measured.

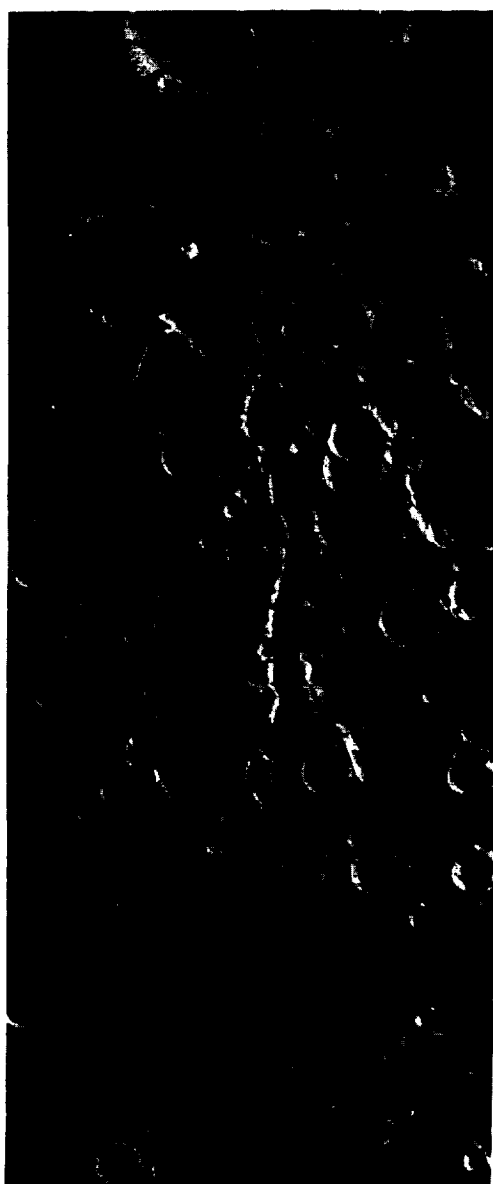


Fig. 1. Ma'adim Vallis. Note the dark material extending north from the mouth of the channel. Area shown is 340 km wide (14°S to 28°S , 180°W to 186°W). Photomosaic is from (10).

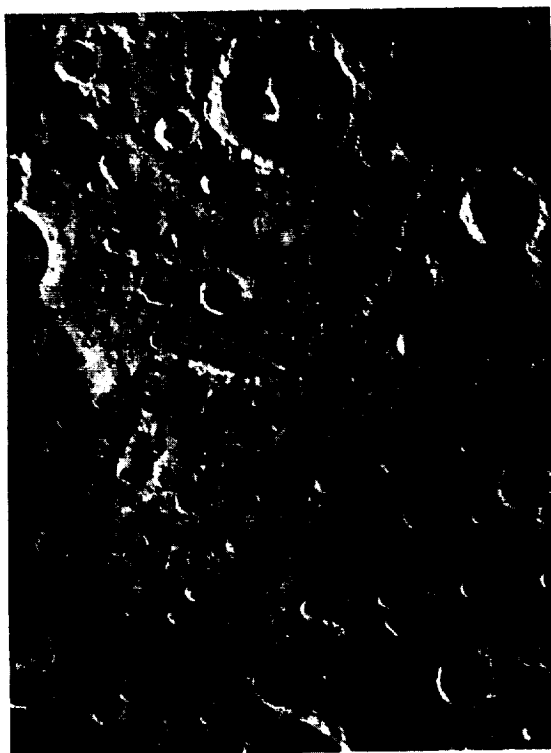


Fig. 2. Al-qahira Vallis. Note the rectilinear pattern of the channel. Area shown is 400 km wide (14°S to 23°S , 194°W to 201°W). Photomosaic is from (10).

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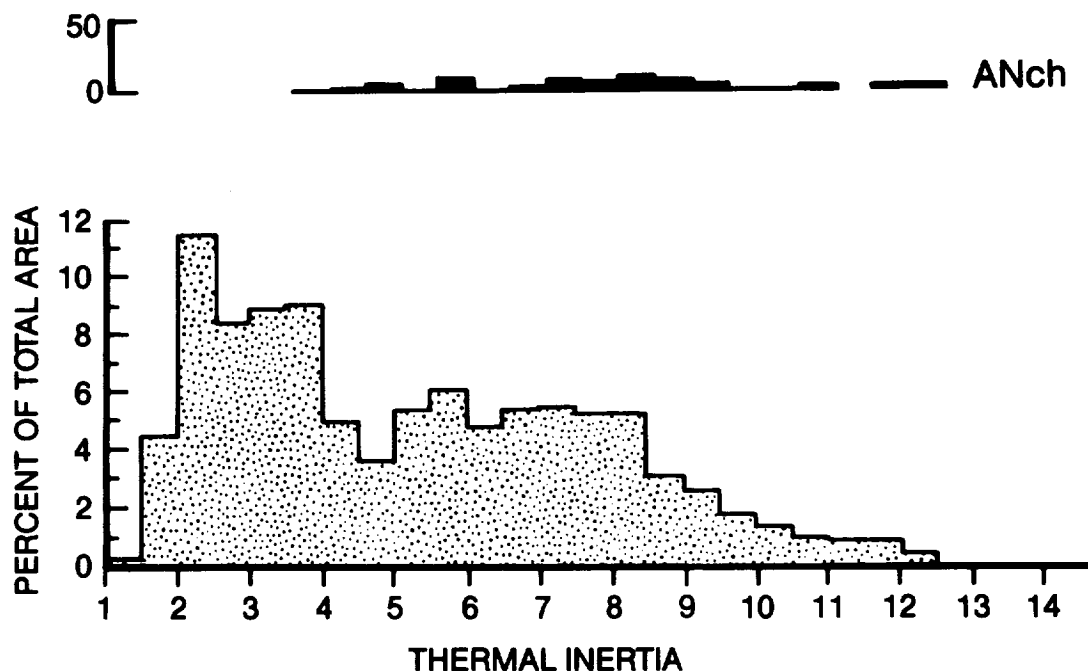


Fig. 3. Thermal inertias for channel material (top, solid) and all of the $1.7 \times 10^6 \text{ km}^2$ measured within the Elysium and Aeolis quadrangles with high resolution thermal data (bottom, stippled). Vertical axis on channel distribution is the number of $1/4^\circ$ by $1/4^\circ$ latitude-longitude bins having the thermal inertias indicated by the horizontal axis. Note the wide distribution of thermal inertias (in units of $10^{-3} \text{ cal cm}^{-2} \text{ s}^{-1/2} \text{ K}^{-1}$) for the channel materials. The bimodal cumulative distribution results from predominantly low thermal inertias on the northern plains and predominantly high thermal inertias on the southern highlands. The unit name ANch indicates that the age of the channels is from (A)mazonis to (N)oachian (4). Thermal data are from (2,6).

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